

**The Prior Art**

EP 709,499 Auerbach (Auerbach); U.S. 4,454,189 Fukata (Fukata); U.S. 6,130,292 Harwood et al (Harwood); U.S. 4,950,529 Ikeda et al (Ikeda); EP 353,717 Senga (Senga).

**The Rejections**

Claims 1, 8, 10, 18 and 21-24 as unpatentable over Auerbach in view of Fukata.

Paragraph 3 of the Action.

Claims 1, 18 and 21-22 as unpatentable over Harwood in view of Fukata. Paragraph 4 of the Action.

Claims 1, 18 and 21-22 as unpatentable over Ikeda in view of Fukata. Paragraph 5 of the Action.

Claims 6, 8 and 10 as unpatentable over Harwood or Auerbach, each in view of Fukata and Senga. Paragraph 8 of the Action.

**Traversal**

Applicants present their traversal of the rejections below. They first introduce the 132 Declaration. Table 1 Results of Capillograph Measurement, Fig. 1, Fig. 2, Tables and Figures and Table 1 presenting results from Example 1 to Com. Exp. 3 are taken literally from the 132 Declaration.

**The 132 Declaration**

**On the non-Newtonian Coefficient (N)**

The Examiner's position is that the Fukata fibers inherently have a non-Newtonian Coefficient of 1.05-1.20. See the Action, fourth paragraph on page 3.

"RYTON" P-4 is supplied from Phillips Petroleum Co. A sample of "RYTON" described in Example 4 of Fukata has a value of 1.67 for non-Newtonian coefficient with a melt viscosity of 2310 poise (or 23.1 Pa's) as shown in Table 1 and Figs. 1 and 2.

As is seen in Table 1, the non-Newtonian Coefficient (N) of 1.67 for "P-4", which is a highly cured product, is equivalent to the N values of 1.56 for "K-4G (highly cured product: DIC)," 1.80 for "LD-10G (mildly cured product: DIC)," 2.04 for "LT-30G" (TCB branched product: DIC)," and 1.49 for "M2100 (cured produce: Toray)," and significantly different from the N values of 1.05 for "T-1G (non-cured product: DIC)" and 1.10 for "ML305 (linear product: DIC)" produced by DIC.

**Table 1: Capillograph Measurement**

Results of Capillograph Measurement

For U.S. Patent Application No. 09/317,986

(MITSUI CHEMICAL ANALYSIS CENTER)

Supplier	DIC	DIC	DIC	DIC	DIC	Toray	Phillips
Grade	T-1G	ML305	K-4G	LD-10G	LT-30G	M2100	P-4
L/N	1D1X088G	#D180	1D4R001G	1C10LD1G	1R90001G	1R08002	80-7-0397
V6 (Pa·s)	35	54	223	1380	3120	163	231
V6 (poise)	350	540	2230	13800	31200	1630	2310
N	1.05	1.10	1.56	1.80	2.04	1.49	1.67
Comment	Non-cure	Linear	Highly cure	Mild cure	TCB branch	Cure	Highly cure

N : Non-Newtonian Coefficient

Conditions for Measurement

Apparatus : Capillograph-1B (Toyo Seiki Kogyo Co., Ltd.)

Temperature : 300°C

L/D : 40/1

These differences are shown in Figs. 1 and 2. Figs. 1 shows the relationship between the non-Newtonian Coefficient (N) and Viscosity V6 (Pa, s) and Fig. 2 shows also the relationship between the non-Newtonian Coefficient (N) and Viscosity V6 (poise).

**Fig. 1 and Fig. 2**

Fig. 1

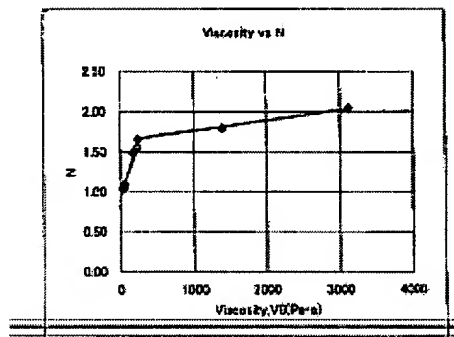
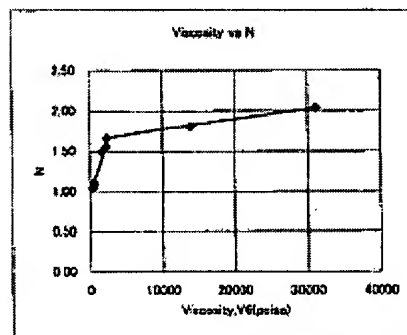


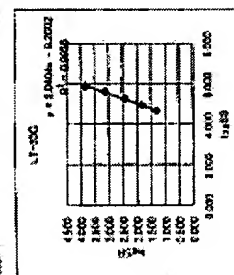
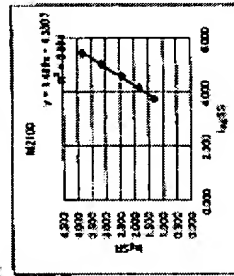
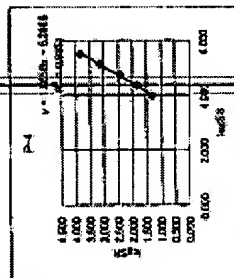
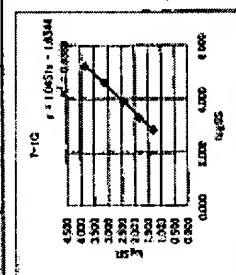
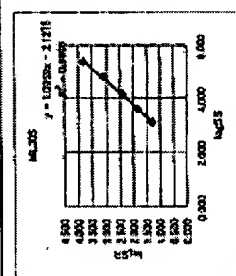
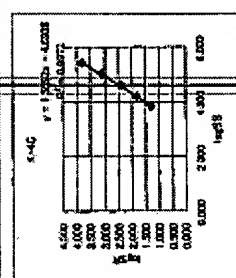
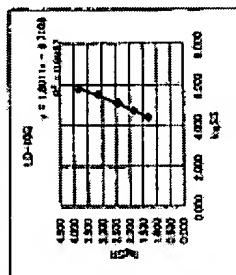
Fig. 2



## Tables and Figures

## Tables and Figures

Year of Investment	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973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In the Tables and Figures above, the non-Newtonian Coefficient (N) of all kinds of PPS polymers currently measured for commercially available PPS polymers substantially falls in a range of 1.05 to 2.04, or around a range of 1-2.

#### **On Melting Point and Melt Viscosity**

With respect to "P-4," its measured melting point of 276.5°C corresponds to a melting point of 277°C of "RYTON" in Example 4 of Fukata, and the measured melt viscosity of "P-4" is 2310 poise at 300°C as shown in the column "Phillips" P-4 in the Tables and Figures, whereas the melt viscosity of "RYTON" in Example 4 of the cited reference is 2200 poise, giving a viscosity difference of 110 poise between "P-4" and "RYTON" of the cited reference.

As is clear from Table 1, the non-Newtonian Coefficient (N) of 1.67 for "P-4," which is a highly cured product, is equivalent to the N value of 1.56 for "K-4G (highly cured product: DIC)," 1.80 for "LD-10G" (mildly cured product: DIC)," 2.04 for "LT-30G" (TCB branched product: DIC)," and 1.49 for "M2100 (cured product: Toray)," and is significantly different from the non-Newtonian Coefficient (N) of 1.05 for "T-1G (non-cured product: DIC)" and 1.10 for "ML305 (linear product: DIC)".

These differences are shown in Figs. 1 and 2. Fig. 1 shows the relationship between non-Newtonian Coefficient (N) and Viscosity V6 (Pa, s) and Fig. 2 shows also the relationship between the non-Newtonian Coefficient (N) and Viscosity V6 (poise).

As is seen in both Figs. 1 and 2, the N value of "P-4" is a line with a gently declining slope corresponding to the N values of high melt viscosities including the N values of 1.80 for "LD-10G" (mildly cured product: DIC)," and 2.04 for "LT-30G (TCB branched product: DIC),"

which are different from the N values of 1.05 for "T-1G (non-cured product: DIC)," and 1.10 for "ML305 (linear product: DIC)," as well as the N values of 1.49 for "M2100 (cured product: Torray)," and 1.56 for "K-4G (highly cured product: DIC) on the line with a sharp declining slope.

The PPS polymer of the present invention has a non-Newtonian coefficient (N) of 1.05-1.20 (claim 1), preferably of 1.06-1.19 (claim 21) and a melt viscosity ( $V_6$ ) of 295-400 poise as shown in Table 1 (PAS-1, PAS-2, PAS-5 and PAS-6) - see claim 22 - in the specification as shown below. Thus, the melt viscosity is far lower than that of "M2100," "RYTON" of the cited reference, "K-4," "P-4" supplied from Phillips, "LD-10G" and "LT-30G" in a range of 1630-31200 poise.

**The Obviousness Rejection over Auerbach in view of Fukata**

Major distinguishing features of the present invention are found in that the present invention makes it possible to produce non-woven fabrics from a PPS polymer having extremely low melt viscosities in a stable manner by melt-blowing under a high-velocity air stream. See page 19, lines 2-5 and Example 1 in the present specification.

With respect to the rejection over Auerbach in view of Fukata, at page 3 of the Action, third full paragraph, the Examiner refers to Auerbach and at that same page in the fourth full paragraph, the Examiner refers to Ikeda. It is assumed that the Examiner means to refer to Auerbach in both instances.

Claim 1 of the present application calls for: "A melt-blown, non-woven fabric having an average fiber diameter of 10  $\mu$ m or less comprising polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20."

With respect to the rejection over Auerbach in view of Fukata, Auerbach is silent regarding any polyarylene sulfide (PPS) polymer having a non-Newtonian Coefficient of 1.05-1.20 as recited in claim 1. Auerbach does teach the use of a 300 poise polyarylene sulfide (page 7, lines 23-25 of Auerbach) as the Examiner states in the Action (page 3, third paragraph).

However, it appears quite clear that the essential basis for the Examiner's rejection is that the Fukata fibers inherently have a non-Newtonian Coefficient of 1.05-1.20 (page 3, fourth paragraph of the Action).

The 132 Declaration clearly establishes this is not the case. See the discussion under **On the non-Newtonian Coefficient (N)**.

Thus, the Examiner's inherency position is seen to be incorrect.

With respect to the Examiner's obviousness position, a major distinguishing feature of the present invention is that the present invention makes it possible to produce non-woven fabrics from the PPS polymer of the present invention having an extremely low melt viscosity in a stable manner by melt-blowing using a high-velocity air stream. See the present specification at page 19, lines 2-5 and Example 1.

With respect to the rejection over Auerbach in view of Fukata, Applicants respectfully submit that there is nothing of record which would lead one of ordinary skill in the art to the

narrow non-Newtonian Coefficient (N) values of the present invention. Thus, no matter what view is taken of Auerbach or Fukata, there is no motivation in the prior art to discover "optimum or workable ranges" since neither Auerbach or Fukata suggests that the non-Newtonian Coefficient (N) as claimed would in fact be the only operable or workable range. The 132 Declaration shows that the prior art does not suggest inherently or certainly does not teach motivation to reach the 1.05-1.20, preferably 1.06-1.119 range, for the non-Newtonian Coefficient (N) of the present invention.

Applicants believe that the above position is established by a careful review of Fukata, as now presented.

In contrast to the present invention, Fukata's "RYTON" polymer has a melt viscosity of 2000 poise and is extruded through a spinneret having small holes, the extrudates being introduced into an aspirator, followed by discharging the extrudates from the aspirator at a rate of 1700 m/min to obtain PPS filaments (see col. 6, lines 44-59, Example 4 of Fukata). Such procedures are completely different from the present invention in not using a melt-blowing method.

Further, Applicants wish to strongly emphasize that Fukata teaches that to produce a web of filaments of the Fukata PPS polymers, it is necessary to subject the collected PPS filaments to bonding or interlocking by needle punching or water jet interlocking (see col. 3, lines 18-41; col. 4, lines 52-59; and claims 12, 18 and 19 of Fukata). This teaching would be positive proof showing to one skilled in the art that the Fukata sheet of PPS filaments is not produced by a melt-blowing method.



The non-Newtonian Coefficient (N) of 1.05-1.20, is an essential factor required for the PPS polymer of the present invention. It can thus be said that a polyarylene sulfide having a non-Newtonian Coefficient (N) and having a branched structure as claimed having an (N) in the range of  $1.05 \leq n \leq 1.20$  is necessary to achieve the results of the present invention.

The non-Newtonian Coefficient of 1.67 for "RYTON" P-4 falls outside the range of  $1.05 \leq n \leq 1.20$  of polyarylene sulfide having a branched structure or a crosslinked structure as claimed in the present application.

"RYTON" P-4 supplied from Phillips Petroleum Co., is a highly cured product and has a non-Newtonian Coefficient (N) of 1.67 and a melt viscosity of 2310 poise, which value is far higher than that of the PPS polymer of the present application, and does not inherently have a non-Newtonian coefficient (N) of 1.05-1.20, but has a non-Newtonian coefficient (N) of greater than 1.20.

In distinction, a polyarylene sulfide having a branched structure as claimed has a non-Newtonian Coefficient (N) with a branched structure in the range of  $1.05 \leq n \leq 1.20$ .

Neither Auerbach or Fukata, taken alone or in combination, teaches or suggests a polyarylene sulfide having a branched structure with a non-Newtonian coefficient of 1.05-1.20.

With respect to claims 8, 10, 21 and 22, Applicants rely upon their arguments above regarding claim 1.

With respect to claim 18, Applicants rely upon the above arguments regarding claim 1.

With respect to claims 23 and 24, Applicants again rely on their arguments regarding claim 1.

Withdrawal of the rejection over Auerbach in view of Fukata is requested.

**The Rejection Over Harwood in view of Fukata**

Applicants first address Harwood.

Harwood teaches a resin composition for melt blowing consisting essentially of a polyarylene sulfide which is cured or semi-cured and a polyolefin blended in an amount of about 1-40% by weight of the total blend for melt blowing (see Abstract; claim 1, and col. 5, lines 36-65 of Harwood). Thus, although Harwood teaches melt blown polyarylene sulfide fibers, particularly polyphenylene sulfide PPS fibers, the Harwood PPS used for melt blowing is blended with a polyolefin having, e.g., a melt flow rate of 35-40g/10 min measured at 318°C under a 5 kg load (see col. 5, lines 32-35 and lines 43-45 of Harwood), which is different from the present invention in using polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20 without blending with such a polyolefin as used in Harwood.

Although Harwood teaches melt blown fibers having a diameter ranging from less than 1 micron up to about 12 microns or more (see col. 7, lines 58-64 of Harwood), Harwood is silent regarding any polyarylene sulfide having a non-Newtonian Coefficient of 1.05-1.20 with a branched structure.

The Examiner states at page 5, lines 6-8 of the Office Action that:

"It is the Examiner's position that Harwood's fibers inherently have a non-Newtonian Coefficient of 1.05-1.20, because said fibers are subjected to similar grafting process as applicant."

The flaw in the Examiner's reasoning here is that there is nothing of record which would correlate any "grafting process" with any non-Newtonian Coefficient. The plain fact is that of the universe of PPS materials, there can be no question but that many which can be grafted

would not have a non-Newtonian Coefficient as claimed. Simply stated, there is nothing of record which correlates any "grafting capability" with any non-Newtonian Coefficient, and for this reason alone, the Examiner's reasoning regarding inherency in Harwood is without basis.

Further, again Applicants wish to emphasize that the Harwood fibers are produced from a composition of polyarylene sulfide issue blended with a polyolefin in an amount of about 1-40% by weight of the total blend.

As earlier discussed, and as established by evidence of record, the Fukata fibers in Example 4 do not inherently have a non-Newtonian Coefficient (N) of 1.05-1.20, rather, have a non-Newtonian Coefficient of greater than 1.20.

Thus, neither Harwood nor Fukata, taken alone or in combination, teach or suggest the use of a polyarylene sulfide having a branched structure which has an non-Newtonian Coefficient of 1.05-1.20.

Accordingly, Applicants submit that claim 1 stands unobvious over Harwood in view of Fukata.

With respect to claims 8 and 10, 18, 21 and 22, Applicants rely on their arguments regarding claim 1.

**Rejection over Ikeda in view of Fukata**

Applicants first address Ikeda.

Ikeda discloses a fabric composed of an extra fine fiber having a mean diameter of 0.1-8.0  $\mu\text{m}$  obtained by melt-blowing a linear polymer of polyphenylene sulfide (see claim 1; col. 3, lines 48-55, and col. 4, lines 12-13 of Ikeda). This appears to be because PPS resins generally

have high oxidative properties and are apt to be partially crosslinked, thereby leading to problems when conventional spinning and drawing techniques are applied thereto (see col. 3, line 56 to col. 4, line 7 of Ikeda). Ikeda is thus different from the invention of claim 1 calling for that: "A melt-blown, non-woven fabric having an average fiber diameter of 10  $\mu$ m or less comprising polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20".

The Examiner states at page 7, lines 6-7 of the Office Action that:

"It is the Examiner's position that Ikeda's fibers inherently have a non-Newtonian Coefficient of 1.05-1.20."

However, Applicants respectfully submit that the Examiner's position on Ikeda regarding inherency is incorrect at least because of the fact that the Ikeda fibers are produced from a **linear** polymer of polyphenylene sulfide.

Thus, Ikeda fails to teach a melt-blown, non-woven fabric obtained by extruding a branched or crosslinked PAS polymer alone having a non-Newtonian coefficient of 1.05-1.20, as Ikeda clearly recites "an extra fine fiber obtained by melt-blowing a linear polymer of polyphenylene sulfide", quite different from that recited in claim 1 or claim 18 of the present application.

Further, the Fukata fibers in Example 4 do not inherently have a non-Newtonian Coefficient (N) of 1.05-1.20, rather have a non-Newtonian coefficient (N) of more than 1.20.

As is clear from the foregoing, none of Ikeda and Fukata, taken alone or in combination, teaches or suggests the polyarylene sulfide having a branched structure or a crosslinked structure with a non-Newtonian Coefficient of 1.05-1.20.

Accordingly, Applicants respectfully submit that Ikeda taken with Fukata do not render the claims herein obvious.

With respect to claims 8, 10, 21 and 22, Applicants rely upon their arguments regarding claim 1.

**The Rejection over Harwood or Auerbach in view of Fukata and Senga**

As should be clear from the foregoing discussion, none of Harwood, Auerbach or Fukata, taken alone or in any combination thereof, teaches or suggests a polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20 as recited in claim 1 of the present application.

Therefore, with respect to claims 6, 8 and 10 of the present application, their patentability over Harwood or Auerbach in view of Fukata is clear at least by virtue of the basis of their dependence from claim 1.

Senga teaches a polyarylene sulfide having an inherent viscosity  $[\eta]_{inh}$  of 0.1 to 0.5/0.5 dl/g; a weight-average molecular weight of  $1 \times 10^4$  to  $2 \times 10^5$ ; and a ratio of inherent viscosity  $[\eta]_{inh}$  to calculated viscosity  $[\eta]$  ( $[\eta]_{inh}/[\eta]_{calc}$ ) of 0.4/1 to 0.8/1. If the ratio of inherent viscosity to calculated viscosity is below the lower limit, the degree of crosslinking becomes too high so that the resin becomes too brittle and the viscosity becomes too high, thus making moldability poor. Furthermore, the polyarylene sulfide may gel upon polymerization, thereby making stable manufacture difficult. On the other hand, if the ratio exceeds the upper limit, the non-Newtonian behavior becomes too small to effectively prevent the occurrence of molding flash upon injecting molding (see page 3, line 43 to page 4, line 6 of Senga).

Senga is silent regarding not only regarding a polyarylene sulfide to be used for the melt blown fibers but also regarding the range of the non-Newtonian coefficient of the polyarylene sulfide having a branched structure with a non-Newtonian coefficient of 1.05-1.20 suitable for melt blown fibers.

Applicants thus respectfully submit that claims 6, 8 and 10 are not rendered obvious over Harwood or Auerbach, each in view of Fukata and Senga.

Accordingly, withdrawal of the rejection is requested.

#### **Unexpected Results**

Applicants present below Table 2 which is fairly based with some deletions on Table 1 at page 21 of the specification where "O" means Good Melt-Blowing Stability and "Δ" means Poor Melt-Blowing Stability.

Table 2

Run	Non-Newtonian Coefficient N	Average Fiber Diameter (μm)	Process Condition
Comp. Ex. 2	1.00	13.1	Δ
Comp. Ex. 1	1.02	15.0	Δ
Example 4	1.06	5.7	O
Example 2	1.09	8.1	O
Example 1	1.13	7.5	O
Example 3	1.19	9.5	O
Comp. Ex. 3	1.22	17.3	Δ

Keeping in mind that the N range in the broader claims herein is 1.05-1.20, what do the data show?

First, the data show consistency, i.e., it is believed that the best comparison which establishes the criticality of the non-Newtonian coefficient is a comparison between Comparative Example 1 ( $N = 1.02$ ) versus Example 4 ( $N = 1.06$ ) and a comparison between Example 3 ( $N = 1.19$ ) versus Comparative Example ( $N = 1.22$ ). All remaining Examples and the remaining Comparative Example present data entirely consistent with the data relied upon and shown.

Thus, Applicants respectfully submit that it is clear from Table 2 that the symbol “O” (good melt blown stability without clogging the nozzles in a die) and “Δ” (poor melt blown stability with clogging the nozzles in die), show the evaluation of process conditions and establish the difference between “O” and “Δ” is quite distinct and dramatic, i.e., in accordance with the invention die clogging takes place whereas in accordance with the prior art die clogging does not take place.

One major feature of the present invention lies in the fact that each fiber which constitutes the non-woven fabric of the present invention has an average fiber diameter of  $10\text{ }\mu\text{m}$  or less. It is very difficult to obtain such a fine fiber in itself. As a consequence, it is essentially technically impossible to arrange fine fibers having various kinds of  $N$  values for the non-Newtonian coefficient alone which would have a simple or sole size of a single average diameter of  $10\text{ }\mu\text{m}$  or less. Table 2, Applicants submit, shows that the process conditions for melt-blowing can be synergistically improved by following a range of average diameter of the non-woven fabric and a range for the non-Newtonian coefficient as claimed in the present application.

The present specification does not teach or suggest that it is solely the non-Newtonian coefficient which leads to the results of the present invention, rather, as shown in Table 2, both the range on the average fiber diameter and the range of the non-Newtonian coefficient are important factors.

In view of Table 2 above, the criticality of the non-Newtonian coefficient is clearly illustrated based upon a comparison between Comparative Example 1 and Example 4 and a comparison between Example 3 and Comparative Example 3.

"Process Condition" in the 4<sup>th</sup> column of Table 2 represents melt-blowing stability disclosed on page 20, lines 9-14, and page 21, lines 8-17, of the specification of the present application such that:

"O": Good melt blown stability without clogging the nozzles in a die and forming melt blown, non-woven fabrics having a uniform basis weight; and

"Δ" : Poor melt-blown stability with the nozzles often clogged in a die and forming melt blown, non-woven fabrics having a non-uniform basis weight.

That is, as is clear from the symbols " O " and "Δ" each showing the evaluation results of the process conditions, the difference between " O " and "Δ" is clearly found in whether or not the die clogging takes place.

Namely, to achieve the uniform structure of the fabrics with a uniform basis weight, fiber diameters of the fibers in the non-woven fabrics are required to be in a specified narrow range, for instance, a constant diameter in an ideal case. When fiber diameters of the fibers in the non woven fabrics are distributed in a wide range, for instance, each having an uneven diameter, the



structure of the fabrics becomes not uniform, having a non-uniform basis weight. Accordingly, the uniformity of fiber diameters in the non-woven fabrics can be finally attributed to whether or not die clogging takes place.

In conclusion, die clogging causes the fiber diameters of the fibers to become small and, clogging the nozzles leads to the development of an accumulation of pressure in the die, which is blown off, thereby making the fiber diameters thereof large. Accordingly, the expression of "good" or "poor" for "Melt-Blown Stability" in the 5<sup>th</sup> column of Table 1 on page 21 of the specification is clearly different.

**Statements Regarding Shear Stress and Rate of Shear**

At the top of page 3 of the Action, regarding Auerbach, the Examiner believes that it would have been obvious to reach the non-Newtonian Coefficient of the present claims "by the reasonable expectation of varying the shear stress and rate of shear.", here referring to Auerbach. The Examiner makes a similar statement at page 5 of the Action, third full paragraph regarding Harwood and at page 7 of the Action, third full paragraph, regarding Ikeda.

Applicants would like to offer a few comments thereon.

The non-Newtonian coefficient is shown by the following equation (1'):

$$\text{Shear Rate} = (\text{Shear Stress})^N \quad (1'),$$

wherein K is a constant and N is a non-Newtonian coefficient.

Applicants have calculated the relation between Shear Rate (SR) and Shear Stress (SS) with respect to each N of 1.0, 1.2, 2.0, 3.5 and 25 under K obtained from a PPS polymer having N of 1.03, and the results are shown in Figs. 5 and 6 below.

Fig. 5

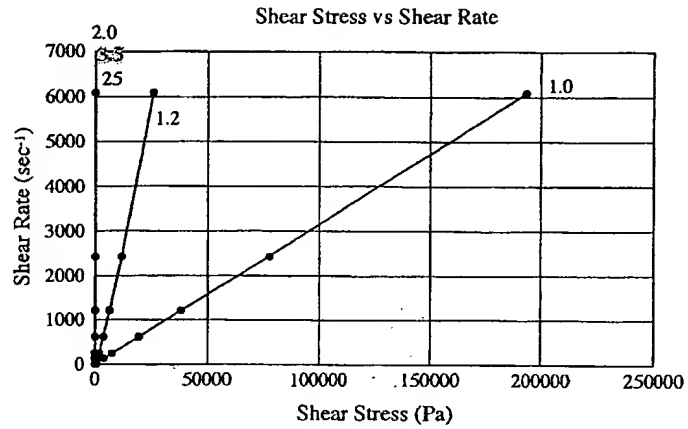
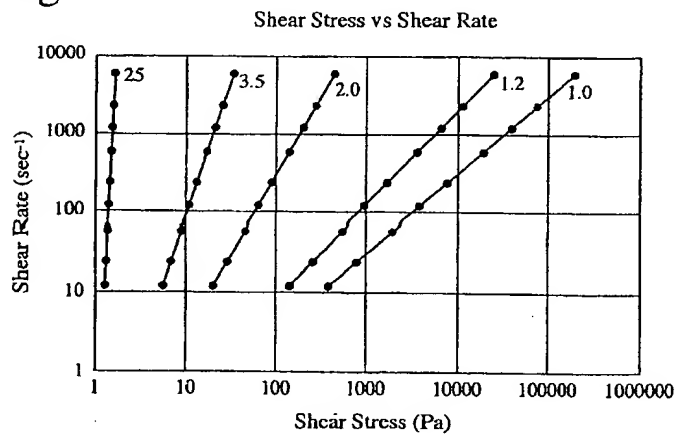


Fig. 6



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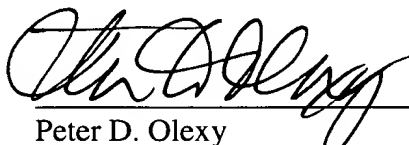
In Figs. 5 and 6 above, each N value was calculated under a constant value of K. These figures clearly teach that the PPS polymers having N exceeding 2.0 produce a remarkable change in Shear Rate by any change in Shear Stress, and, accordingly, it is difficult to take a flow having N exceeding 2.0 into consideration.

Applicants thus respectfully submit that there is no basis to conclude motivation "by the reasonable expectation of varying the shear stress and rate of shear."

For all of the above reasons, withdrawal of the rejections and allowance is requested.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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